RAMBOLL

ENVIRONMENT
& HEALTH

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RESPONSE TO EPA COMMENTS ON DOCUMENTS PROVIDED VIA EMAIL DATED AUGUST 13, 2018 FROM VOGEL PAINT & WAX - MAURICE IOWA SUPERFUND SITE

Date December 7, 2018

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Dear Messrs. Mehta and Jackson:

Ramboll US Corporation (Ramboll) has prepared this Response to Comments letter, on behalf of Vogel Paint and Wax Company, Incorporated (Vogel), to respond to United States Environmental Protection Agency (USEPA) draft comments provided to Iowa Department of Natural Resources (IDNR) dated September 11, 2018 for possible further comment. IDNR provided USEPA comments to Vogel on October 24, 2018, with no additional comments. The draft comments were deemed final by USEPA via email to Vogel on November 13, 2018. As stated in the response to comments below, some of the comments will be addressed and/or further discussed in the scheduled meeting between Vogel and USEPA and IDNR on December 12, 2018 at USEPA office in Lenexa, Kansas.

COMMENTS ON REMEDIAL ACTION WORK PLAN FOR GROUNDWATER REMEDIATION DOCUMENT

1. *Please change the title of this Attachment B to: Pilot Study Work Plan for Enhancement of Groundwater Remediation. Please also remove any references to the original title throughout the document.*
   Vogel has no issue with changing the name of the document. However, this will be discussed with IDNR and EPA during the meeting at EPA Region 7 office on December 12, 2018 (EPA Meeting).

2. *Please clarify if the original remedy of pump and treat the contaminated groundwater that is part of the Consent Order with IDNR is to be replaced with this new treatment technology of bioremediation of contaminants in the groundwater. If that is the case, a modification to the decision documents (Record of Decision (ROD) and Explanation of Significant Differences (ESD)) along with a modification to Iowa Department of Natural Resources (IDNR)'s Consent Order (CO) would also need to be issued. The ROD modification, changing technology for groundwater treatment, would need to be signed by the IDNR and the EPA prior to*

the approval of this Remedial Action Work Plan. Please clarify and confirm that the original remedy of pump and treat shall remain in place and continued to be operated while the bioremediation pilot study is implemented. If bioremediation technology is implemented as pilot study to enhance remediation, goals are set to measure the success of bioremediation technology for treatment of contaminated groundwater, and, to determine when to halt the pilot study, the EPA can support implementation of this work plan to expedite the cleanup of contaminated groundwater. Please clarify the intent in the document.

- The intent of the remedial approach presented in the 8-13-18 work plan is to implement and expand remedial actions at the site to achieve remedial goals as stated under Groundwater Compliance of the October 2000 ESD.
- The proposed approach presented in the 8-13-18 work plan does not include the continued operation of the pump-and-treat system. The cessation, continued operation, or modified operation of the existing pump-and-treat system will be discussed in the EPA meeting.
- An evaluation regarding the performance of the proposed bioremediation will be conducted 6 months following the completion of the injection of materials to stimulate bioremediation within the groundwater contaminate plume. The evaluation will be conducted to assess if additional materials (oxygen-releasing compound, nutrients, and/or bio-augmentation) will need to be injected in the original injection areas and or other portions of the plume. The quarterly groundwater monitoring results collected during the first 12 months following injection activities will be compared against the following goals.
  - Dissolved mass reduction of 50% based on results from former source area wells GMW-13 and GMW-14.
  - Decreasing concentration trend in on-site interior wells located within the plume between the former source area and the downgradient property perimeter wells.
  - Reduction of chemicals of concern (COC) concentrations in downgradient property perimeter wells GMW-20 and GMW-7R to below MCLs.
  - Reduction of chemicals of concern (COC) concentrations in off-site wells GW-21 and GMW-22 to below MCLs.
  - Decreasing concentration trend in on-site interior wells located within the plume between the former source area and the downgradient property perimeter wells.
  - Total bacterial populations and key degradation enzymes (i.e., monoxygenases and dioxygenases) responsible for BTEX degradation are present in sufficient quantities.

3. *Please provide geologic cross-sections as a line of evidence. These geologic cross-sections should accurately depict the geologic setting, depth to water, extent of the source material, well screen intervals and dissolved phase plume with latest concentrations along with proposed injection sites/injection intervals.*

   Requested cross-sections will be included in revised work plan.

4. ***Section 1.1, Page 1, Paragraph 1.*** *Please modify the last sentence to read as follows: ….., and an approach to enhance the RAOs.*

Change has been made.

5. ***Section 1.2, Page 1, Paragraph 1/2.*** *The text indicates disposal activities occurred in the former sand and gravel pit roughly in the center of the Site. Please depict the location of this pit in the referenced Figure 2.*

   This will be included in revised work plan.

   Please ensure consistency between this paragraph and Section 1.3, page 3, 3rd bullet for the estimated free product that has been removed or remediated. Please correct the numbers accordingly.

   Revised to the more accurate number of 143,175 gal.

6. *Section 1.3, Page 2, Bullet 5. The text indicates soils with elevated lead were stabilized and buried at least 5 ft above groundwater. The technical memorandum, "Metals Contamination", 3rd paragraph, indicates the treated soils were at least 4 feet above groundwater. Please ensure consistency with the earlier decision documents, and correct the depth of soils to which they were buried.*

   Technical Memorandum has been modified indicating … at least 5 feet above groundwater.

7. ***Section 2, Page 5.*** *The decision documents that are currently in place provide information on the Remedial Goals. These documents are in place as part of the existing IDNR COs. In addition, the EPA document, "Guidance for Evaluating Completion of Groundwater Restoration Remedial Actions" provides information to assist with the determination of completion of a groundwater restoration remedial action. The EPA also recommends evaluating contaminant concentrations on an individual well-by-well basis to assess whether aquifer restoration is complete. Please also see comment 2 above and provide clarification to the intent.*

   As mentioned in comment 2, if the intent is to implement bioremediation technology to enhance the current groundwater treatment, a specific set of goals to measure the success and completion of this pilot study would be required in this document. Please incorporate the specific goals to this pilot study.

   Please see responses to Comment 2 above.

   This comment applies to all comments 8 through 15 provided below.

8. ***Section 2, Page 5, Paragraph 2.*** *The text indicates the goal of the remedy is to reduce concentrations to below Maximum Contaminant Levels (MCL) or standards set by the IDNR. The use of "or" is only appropriate if the IDNR standards are more conservative the MCLs. In addition, please correct the statement to ensure consistency with the currently existing decision documents and COs.*

   For BTEX compounds, the IDNR standards are the same as the MCLs; therefore, the MCLs are the established cleanup goals for groundwater at the property boundaries as defined in the October 31, 2000 ESD and the May 2003 CO.

9. ***Section 2, Page 5, Paragraph 3.*** *The text indicates that RAOs are qualitative statements that identify the scope of remediation necessary to protect human health and the environment. None of the indicated RAOs accomplish this task. Please modify accordingly. Alternate technology specific applicable goals could be to implement an in-situ bioremediation remedy to accelerate reduction of the on-site*

BTEXs in the groundwater, to monitor groundwater to evaluate the effectiveness of the alternate remedial technology, to expedite cleanup of groundwater to reach MCLs, etc.

RAOs will be defined as the following:

- Remove remaining residual light non-aqueous phase liquids (LNAPL [free product])
- Restrict further migration of the groundwater plume off-site
- Reduce dissolved phased contaminant (COCs) concentrations below the drinking water standards at the downgradient property boundary, designated as the point of compliance. (Consistent with the 2000 ESD)

10. ***Section 2, Page 5, Paragraph 4, Bullet 1.*** *The text indicates mass reduction and reduction rates as criteria to evaluate the RAOs. This would be a specific goal applicable to the bioremediation, and needs to be corrected accordingly. In addition, please provide the baseline of the current conditions by discussing the quantitative understanding of source mass at the site, groundwater flow and preferential pathways, contaminant phase distribution and partitioning between soil, groundwater and soil gas, rates of biological transformation, and how these factors will vary/impact over time. Please provide the initial contaminate mass that will be used to provide the percentage of mass reduction along with the reduction rate.*

    The current estimated dissolved-phase mass of the COCs at concentrations above the MCLs is estimated to be 3,380 pounds (lbs.), with a corresponding adsorbed mass within the water-bearing zone over the same area that is estimated to be 13,200 lbs., for a total estimated contaminant mass of 16,580 lbs.

11. ***Section 2, Page 5, Paragraph 4, Bullet 2.*** *Please include the statistical trend analysis that will be used to relay the reduction of dissolved phase concentrations over time.*

    Mann-Kendall trend testing will be conducted to statistically evaluate trends in the data sets.

12. ***Section 2, Page 5, Paragraph 4, Bullet 3.*** *Based on the solubility limit of the contaminant constituents in the dissolved phase, the presumptive evidence indicates Light Non-Aqueous Phase Liquids (LNAPL) probably extends over a larger area then just near well MW-4R. Recovery of product from this well may not accurately reflect what is in the formation at and down-gradient of the source area. Please clarify and modify.*

    Section 4.4 of the work plan presents the scope of work to further characterize the extent of possible LNAPL (free product) near Well MW-4R. The site groundwater water monitoring wells have been sounded and sampled for decades in some cases, and LNAPL has not been measured in in other wells since 2004. Although some wells may continue to contain elevated concentrations of COCs, groundwater monitoring of the existing well field has not shown the presence of LNAPL in any of these wells other than MW-4R.

13. ***Section 2, Page 5, Paragraph 4, Bullet 4.*** *The text indicates one of the criteria to evaluate the RAOs is a point of diminishing returns (i.e., asymptotic conditions & remediation effort & cost). The EPA understands that asymptotic conditions may be due to installation of the remedy in an improper hydrogeologic setting thereby inhibiting its inability to adequately reduce contamination to the remedial goals. Please clarify and delete if not applicable.*

Asymptotic concentrations may signal a need to evaluate additional injection of bioremediation materials (oxygen-releasing compound/nutrients/bioaugmentation); however, economic factors will be taken into consideration regarding the level of addition remediation to be conducted to reach remedial goals. Asymptotic concentrations will be used as a criteria to evaluate the extent of the additional remedy and institutional control to achieve site closure.

14. ***Section 2, Page 5, Paragraph 4, Bullet 5.*** *This bullet indicates application of risk-based corrective action process to establish alternative action levels for groundwater. Please indicate the basis for applying this criterion to evaluate meeting the RAOs. Please stipulate the site-specific conditions/circumstances which must be met to validate a recommendation for an alternative action level. The EPA does not provide the option in the decision documents for an alternate concentration limit for cleanup criteria. Understood that EPA will not modify the clean-up goals but has flexibility to allow for closure at levels above MCLs etc. based on site conditions.*

    Removed from the work plan.

15. ***Section 2, Page 5, Paragraph 4, Bullet 6.*** *Please provide information on the modifications under the execution of the environmental covenant that would be used as a criterion to evaluate when this technology specific RAOs have been met.*

    The execution of an environmental convent for the subject property would provide a restriction for the use of groundwater on-site for beneficial uses, such as drinking water. The point of compliance will remain the downgradient property boundary wells where COC concentrations are below MCLs.

16. ***Section 3, Page 6.*** *The text indicates sampling of three plume areas to evaluate in-situ remedial options technologies. A case study from Microbial Insights indicated a background well sample v/s an impacted well sample is warranted to evaluate potential demonstrated growth and enrichment of BTEX degraders within the dissolved plume. Please clarify how this recommendation was considered for the Vogel site.*

    It is unclear which case study the reviewer is referring to; however, a background sample is not needed for an in-situ microcosm study (which we are conducting). The Control (MNA) unit on the Bio-Trap will provide the point of comparison to help assess if the treatments used in the advanced bio-trap units stimulated biodegradation levels in the proposed treatment area.

17. ***Section 3.1.1, Page 7, Bullet 1.*** *The text indicates that well GMW-14 is in the former source area; however, Section 3 indicates the remedial approach was divided into three areas that includes the source area, rather than former source area. Based on the solubility limit (given a range of values exist based on groundwater temperature, etc.) for toluene/ethylbenzene/xylene, the percent of each present in groundwater ranges up to 3%, 12% and 88% respectively based on Figure 4, 5, & 6. These values reflect a presumptive evidence of product indicating the existence of an apparent source material. Please clarify.*

    The work plan will be modified to reference "former source area". The original materials buried at the site have been removed via soil excavation and off-site disposal, on-site soil treatment, and free product recovery and off-site disposal. What remains is residual contamination in the form of dissolved-phase contaminants in groundwater, residual contaminants adsorbed onto soil within the water bearing zone, and an estimated small quantity of free product remaining in the vicinity of

Well MW-4R. The original source materials have effectively been removed/remediated from the site. The "former source area" reflects remaining elevated dissolved-phase contaminant concentrations in groundwater within and immediate downgradient of the former disposal area.

18. ***Section 3.1.1, Page 7, Bullet 4.*** *The first item in this bullet notes that samples collected from all three wells indicate there are significant concentrations of toluene/benzene dioxygenase (TOD) and xylene/toluene monooxygenase (TOL). A review of Table 2 indicates this is the case for TOL but not for TOD which was only detected in 2 of 3 sampled wells. Please clarify and revise.*

    The work plan text has been revised to indicate that two of the three wells contain significant concentrations of TOD.

19. ***Section 3.2.1, Page 7.*** *The text specifies monitored natural attenuation (MNA) parameters. The petroleum hydrocarbons present at this site are typically much more conducive to and effectively remediated by natural attenuation processes (e.g., biodegradation, dilution, dispersion, sorption, etc.) in the distal portion of the plume where oxygen may be more readily available. Long-term monitoring can continue to evaluate natural attenuation processes. Please clarify if MNA is appropriate since the source material remains, and/or, until source control measures are implemented at the site.*

    MNA is not applied in the former source area. MNA is not a direct remedy applied in the work plan. MNA parameters will be monitored in the former source area to evaluate remedial performance following implementation of bioremediation (injection of biostimulant materials) in the former source area.

20. ***Section 3.3.1, Page 8.*** *The text mentions given a long-enough time scale, MNA has the potential to remediate the down-gradient and off-site areas of the plume. The use of MNA is appropriate where it can be demonstrated that the remediation objectives can be achieved within a reasonable timeframe compared to other remedies. According to "An Approach for Evaluating the Progress of Natural Attenuation in Groundwater", (EPA 610/R-11/204, Dec. 2011, John T. Wilson), estimating cleanup times by MNA is a two phase approach: the first phase – evaluate concentration trends (regression analysis) at each well to estimate the date when concentrations can be expected to meet clean up goals; second phase – data are evaluated over the interval of time in a 5-year review cycle which can be effected by high water tables, subtle changes groundwater flow direction, source control measures (GETS, bioremediation), etc. Adequate plume characterization (horizontal/vertical) is key to this effort as degradation rates can vary in different portions of the plume as well as performance monitoring following source remediation. Section 4.1 indicates the use of Bio-Trap units will assist in determining bioremediation timeframes. Please clarify and correct the statement.*

    The Bio-Trap study will primarily provide information on the quantity of nutrients and possible bioaugmentation needed to stimulate and promote bioremediation in the injection areas and continued treatment as groundwater passes through the injection zones. The Bio-Trap provides degradation rates by comparing the percent reduction of COCs between the MNA (baseline/control), treatment A (oxygen-releasing compound), and treatment B (oxygen and amendment). As we are controlling the amount of time the Bio-Trap is deployed, we can then estimate degradation rates (change in chemical concentrations over time) and have the ability to estimate possible bioremediation timeframes in the various portion of the plume to reach the remedial goals.

21. ***Section 3.3.2, Page 9.*** *The text advocates the use of a liquid sorption material (activated carbon) called "PlumeStop" that indicates it will be viable in the subsurface for decades. Please clarify the viability of the material as it relates to the concentrations in the groundwater at this particular site and explain the impacts over time as it relates to the type and concentrations of the specific site contaminants at Vogel.*

    PlumeStop is a liquid activated carbon material. Once injected into the water-bearing zone, the COCs partition out of the aqueous phase and sorb onto the liquid activated carbon matrix. PlumeStop has a high affinity for sorption of BTEX compounds and has a proven track record for remediating these compounds. Once sorbed onto the activated carbon matrix, degradation of the contaminants will occur though biostimulation of the native (and possible augmented) bacterial population. A single application of PlumeStop is estimated to remain functional for approximately 10->20 years. Given the relatively low concentrations of the COCs along the southern property boundary where PlumesStop will be injected, Ramboll anticipated that the PlumeStop barrier will remain viable towards the longer end of the estimated timeframe as stated above.

22. ***Section 4.2, Page 11.*** *The text indicates the proposed injection points will be applied in a grid application over a 20,000 ft2 area as depicted in Figure 8. Please provide information on the horizontal and vertical extent of characterization at this depicted area (source zone). Please provide information, based on the extent of characterization, how and if the injection points will treat the planned treatment area. Please provide information on the methodology to determine the number location, and depth of injection treatments over the planned impacted area.*

    The 20,000-square-foot area where materials will be injected is defined by an area that contains the two wells with the highest COC concentrations (GMW-13 and GMW-14.) The intent is to significantly decrease total mass in this high concentration area by added biostimulants in a dense pattern in this area. Based on the courser grained nature of the water-bearing zone and historical groundwater extraction rates, a 15-foot radius of influence (ROI) was used as a conservative ROI for injection of the materials. The most recent depth- to-water measurement (July 2018) was approximately 12 feet below ground surface (bgs) in Wells GMW-13 and GMW-14. Materials will be injected in a top-down approach, with materials being injected over the thickness of the water-bearing zone from approximately 12 feet to 24 feet bgs.

23. ***Section 4.3, Page 11.*** *Please reconcile the number of permeable reaction barriers (PRB) to be installed and account for the difference in the text and Figure 8.*

    There are 5 strategically-placed PRBs, the work plan text has been revised from 4 to 5 PRBs.

    The text indicates injections in these areas will be spaced 15 ft apart. Please clarify the method to determine the impacts of bio-augmentation product on the plume and, measure the reduction of the plume contamination.

    Bioremediation is a proven technology especially for the COCs at this site. The Bio-Trap study will provide information for the design of quantity and types of materials that will be injected. The performance of the bioremediation PRBs will be evaluated as detailed under Comment 2.

24. ***Section 4.4, Page 11.*** *The text indicates free product was only detected in well MW-4R in 2017 (i.e., 0.3 ft to 2.65 ft). Please show the vertical extent and location of the free products and LNAPLs on plume figures and provide in the document. Please clarify and note in the text if the apparent LNAPL*

thicknesses in a monitoring well typically exceeds the formation thickness. The EPA believes, based on, dissolved phase concentrations, that free product could exist laterally throughout portions of the source area (i.e., exceedance of 1% percent of the COCs solubility limits at several wells; presumptive evidence of LNAPL). Therefore, the EPA recommends additional site characterization efforts throughout the source area (i.e., including around wells GMW-13/14/9R).

Please see response to Comment 12. Monitoring wells GMW-13/14/9R were installed in September 2001 and have never contained LNAPL.

Please include an estimate for the recovery of 3.35 gallons of product.

Please see attached table (See Attachment A) summarizing the free product thickness and volume (3.35 gallons) of free product removed in 2017 by GeoTek.

25. *Please provide a Microsoft Schedule to implement the pilot study and how it relates to the two sampling events that are going to be continued to be implemented as part of the remedy. Please also include the work to be performed for additional groundwater characterization north of the former source area in this schedule and how it relates to the sampling efforts for the two events.*

    Please see attached schedule (See Attachment B).

COMMENTS ON WORK PLAN FOR ADDITIONAL GROUNDWATER CHARACTERIZATION NORTH OF FORMER SOURCE AREA DOCUMENT

26. ***Task 3.*** *Figure 1 shows a typical monitoring well construction diagram depicting the installation of the well screen. Please provide the range of depths to water at the nearest existing well (GMW13), and confirm that the screen will be placed across the water table. Please add an applicable above grade well construction diagram.*

    The most recent depth to groundwater in Well GMW-13 (July 2018) is 11.85 feet bgs, which is the highest water level that has been measured in this well. Depth to groundwater has ranged in Well GMW-13 from 11.85 feet to 17.93 feet. The well screen is anticipated to be from 10 to 25 feet, based on hydrogeologic conditions observed during drilling and will be placed across the water table. Figure 1 has been revised and included in the attached revised groundwater monitoring wells installation protocol (See Attachment C).

27. ***Task 4.*** *Please provide information for screen length to be installed, and clarify the groundwater sample collection interval(s) in these long screens.*

    Employing low-flow sampling methods, the pump will be placed approximately one- third the distance from the water level to the bottom of the screen interval.

28. ***Attachment A.*** *Item 2 indicates groundwater monitoring wells will be installed in the shallow water bearing aquifer at a depth of approximately 80 – 90 ft bgs. Please confirm. Item 2.1 indicates well screens will be 15 ft rather than 15 ft to 20 ft in Task 3. Please review and ensure consistency of information.*

    The text indicates bentonite chips will be placed in approximately 6-inch lifts and hydrated with approximately 1 gallon of potable water per lift. Task 3 indicates the chips will be allowed to hydrate. Please review and ensure consistency.

Item 2.4 indicates the wells will be completed below grade compared to Task 3 indicating above grade. Please review and ensure consistency.

Above comments associated with Attachment A are corrected in attached revised groundwater monitoring wells installation protocol (See Attachment C).

COMMENTS ON TECHNICAL MEMO ON METALS CONTAMINATION SAMPLING DOCUMENT

The EPA review of groundwater results provided with the document indicate that remedial efforts do not appear warranted to address metals contamination at the site. However, additional remediation efforts (bioaugmentation / biostimulation) are currently proposed to enhance cleanup of contaminated groundwater at the site. The bioremediation cleanup efforts may impact the site geochemistry with slow release oxygen product & nutrient amendments that are proposed in the work plan document.

The EPA recommends the incorporation of text discussing the potential impact (mobilization) on metals that may remain in the source area. As part of groundwater monitoring for bioremediation effects, metals analysis should be conducted during the proposed quarterly sampling events. The metals analyses would enable and address any potential impacts that may result from bioremediation of groundwater. The metals analysis would be limited. The EPA believes that four consecutive complete rounds of sampling data showing downward trend with each applicable metal showing non-detect or below the applicable MCL for each well is required to discontinue metal sampling at the site.

Ramboll does not anticipate that the proposed bioremediation activities will impact the current non-detect levels of metals in groundwater and will conduct the requested groundwater monitoring for metals to verify this assumption.

As a note, well GMW-14 (from the source area), last sampled in 2004, had a detection of mercury above the MCL. In such instances, the EPA recommends four additional sampling events for metals at this well to ensure mercury has dropped below the MCL and to ensure it remains so after the reduction.

Understood and will add to monitoring program for Well GMW-14.

Therefore, the EPA does not agree with discontinuing the metals sampling analysis currently performed at the site. Please ensure that this sampling is continued till the impacts from the implementation of bioremediation have been determined. The EPA does agree to re-visit this issue at a later time.

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Understood, results of additional groundwater monitoring will be provided in post-injection reports and an evaluation for discontinuation of metals analysis will be conducted following one year of post-injection monitoring.

Yours sincerely,

Eric Smith

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ES:cet

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ATTACHMENT A
LNAPL REMOVAL SUMMARY 2017

MW4R

Date	Depth to Groundwater	Depth to Product	Product Thickness	Volume of Product Removed
1/5/2017	25.23	24.45	0.78	
1/26/2017	22.10	21.31	0.79	
2/22/2017	21.86	20.93	0.93	0.20 gals
3/2/2017	21.55	20.87	0.68	
3/9/2017	22.30	21.45	0.85	
3/17/2017	21.98	21.20	0.78	
3/31/2017	21.40	20.51	0.89	0.15 gals
4/7/2017	21.85	21.18	0.67	
4/21/2017	21.88	21.08	0.80	0.20 gals
4/28/2017	22.55	21.88	0.67	0.10
5/11/2017	22.80	22.12	0.68	
5/19/2017	22.95	22.34	0.61	
6/1/2017	23.02	22.41	0.61	
6/15/2017	27.11	24.95	2.16	
6/22/2017	27.55	24.90	2.65	0.75
6/29/2017	26.80	25.20	1.60	0.50
7/6/2017	26.60	25.35	1.25	0.25
8/3/2017	26.50	25.51	0.99	0.40
8/10/2017	26.75	25.86	0.89	0.30
8/18/2017	26.50	25.85	0.65	
8/25/2017	26.50	25.50	1.00	
9/1/2017	26.58	25.86	0.72	
9/7/2017	26.60	25.87	0.73	0.30
9/14/2017	26.40	25.88	0.52	
9/29/2017	27.03	26.64	0.39	
10/9/2017	26.41	26.02	0.39	
10/13/2017	26.23	25.83	0.40	
10/19/2017	28.35	27.77	0.58	
10/26/2017	26.09	25.64	0.45	
11/2/2017	26.42	25.99	0.43	
11/9/2017	26.62	26.23	0.39	
11/16/2017	26.61	26.17	0.44	
12/8/2017	26.45	26.09	0.36	
12/22/2017	26.7	26.28	0.42	0.20
12/28/2017	26.65	26.35	0.30	

Notes: Depth to Groundwater and Product is feet below T.O.R.

MW4R Gr. Elev = 1303.58, T.O.R. Elev = 1306.58

Product thickness shown in feet

Volume of Product Removed measured in gallons

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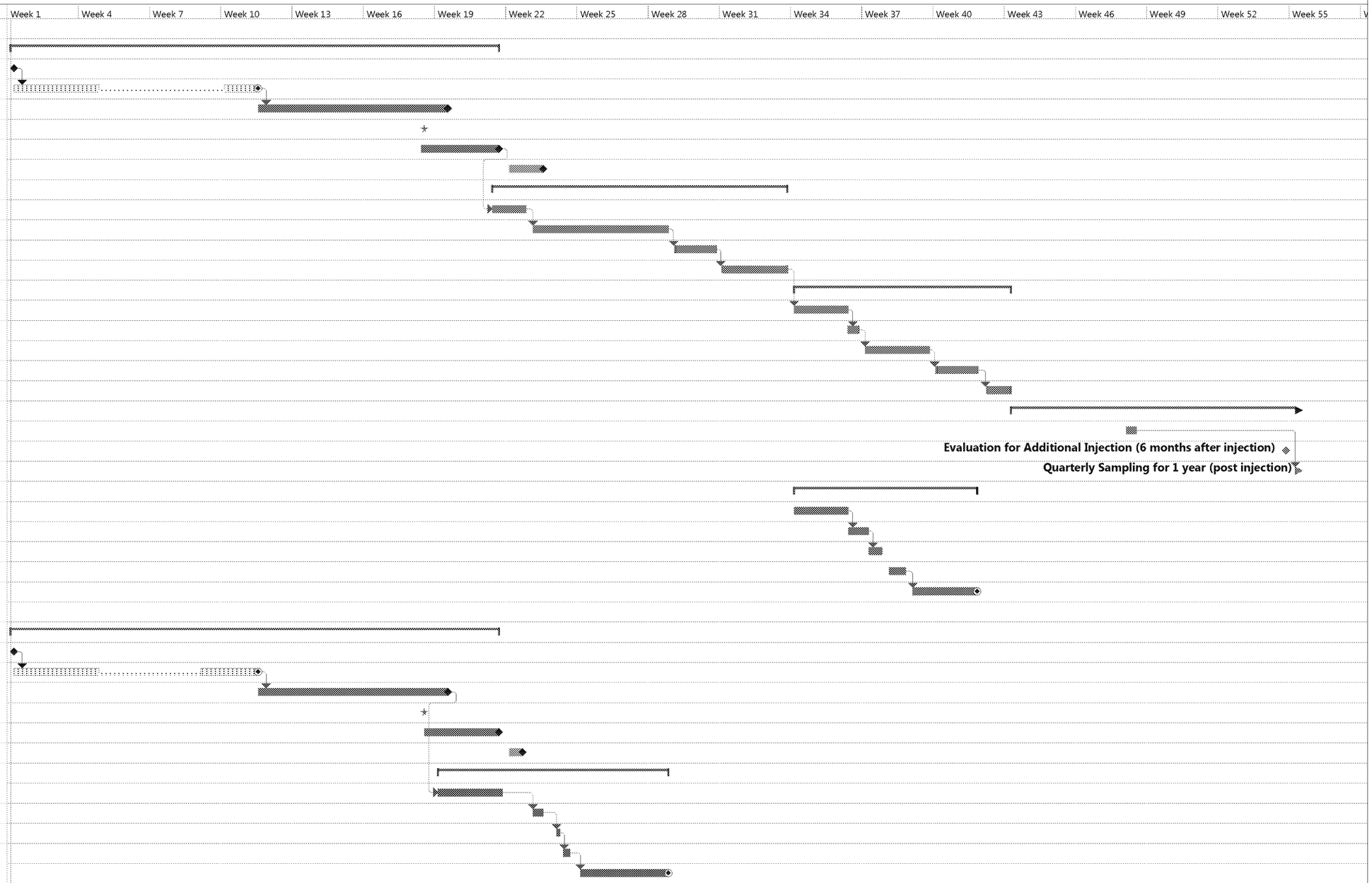
ATTACHMENT B
SCHEDULE

Work Plans Schedule
Vogel - Maurice Iowa

ID	Task Name
1	**Groundwater Remediation Work Plan**
2	**USEPA Approval of Plan**
3	Work Plan Submittal
4	USEPA Review and Comments
5	Response to comments and revised work plan submittal
6	Meeting with USEPA
7	USEPA Work Plan Approval
8	**Health and Safety Plan**
9	**Bio-Trap Study**
10	Prefield Coordination
11	Bio-Trap Deployment Period
12	Bio-Trap Testing
13	Results Evaluation and Final Design
14	**Bioremediation Injection Implementation**
15	Prefield Coordination
16	Baseline Monitoring (pre-injection) (Selected Wells)
17	Injection in former source area
18	Injection/installation of permeable reactive barriers
19	Injection of PlumeStop along property boundary
20	**Initial Post-Injection Monitoring Program**
21	Initial Post Injection Monitoring
22	Additional Injection Evaluation
23	Quarterly monitoring of selected wells
24	**Free Product (LNAPL) Characterization (MW-4R)**
25	Prefield Coordination
26	Additional characteration (temporary borings)
27	Stratigicatlly placed well installation
28	Residual free product remediation evaluation
29	Free Product Remediation Plan
30	**North Area Work Plan**
31	**USEPA Approval of Plan**
32	Work Plan Submittal
33	USEPA Review and Comments
34	Response to comments and revised work plan submittal
35	Meeting with USEPA
36	USEPA Work Plan Approval
37	**Health and Safety Plan**
38	**Work Plan Implementation**
39	Prefield Coordination
40	Installation of Wells
41	Well Development and survey of wells
42	Initial well sampling
43	Results evaluation and report submittal



Date: Fri 12/7/18

Task
Split
Milestone
Summary
Project Summary
Inactive Task
Inactive Milestone
Inactive Summary
Manual Task
Duration-only
Manual Summary Rollup
Manual Summary
Start-only
Finish-only
External Tasks
External Milestone
Deadline
Progress
Manual Progress

ATTACHMENT C
INSTALLATION OF GROUNDWATER MONITORING WELLS PROTOCOL

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INSTALLATION OF GROUNDWATER MONITORING WELLS PROTOCOL

1. INTRODUCTION

This protocol describes the procedures to be followed during the installation of shallow groundwater monitoring wells. Drilling of the soil borings for the well installation will be performed in accordance with the protocol described in the Drilling and Destruction of Soil Borings protocol. The procedures presented herein are intended to be of general use and may be supplemented by a work plan and/or health and safety plan. As the work progresses and if warranted, appropriate revisions may be made by the project manager. Detailed procedures in this protocol may be superseded by applicable regulatory requirements.

2. WELL INSTALLATION

A Daily Field Record will be completed for each day of fieldwork, and the original will be kept in the project files. Monitoring well permits will be acquired from the appropriate agency(s) before drilling is initiated. At each boring location an underground utility check will be conducted before drilling begins. Underground utility checks will, at a minimum, consist of contacting Iowa One Call (811).

Shallow water monitoring wells will be installed in the shallow water bearing aquifer present at the site at a depth of approximately 10 feet below ground surface (bgs). The monitoring wells will be designed to enable measurement of the potentiometric surface and to permit water sampling of the shallow water-bearing zone. Screened intervals for each well will be determined by the field geologist/engineer after consultation with an Iowa Professional Geologist (PG) or State-licensed professional engineer (PE) at the time the wells are installed but in general will be installed approximately 10 feet below and 2-5 feet above the top of the water-bearing zone (i.e., the screened interval will be approximately 10 to 25 feet bgs, assuming a depth to groundwater of approximately 12 feet). Determination of well screen placement will be based on boring lithology. Construction of monitoring wells will be in conformance with the following provisions and will be performed in general accordance with the attached well construction diagram.

2.1 Well Screen and Casing

Well casings will consist of clean, factory new, 2-inch diameter, flush-threaded schedule 40 polyvinyl chloride (PVC) casing. Well screens will consist of 15 feet of 2-inch diameter, flush-threaded schedule 40 PVC casing with factory-milled 0.020-inch slots, and will provide flow between the formation target zone and the well. The base of each well screen will be plugged with a flush-threaded bottom cap. Blank PVC casing will be installed from ground surface to the top of the screen interval in each well.

2.2 Filter Material

Filter material will be well-graded, clean sand (generally less than 2 percent by weight passing a No. 200 sieve and less than 5 percent by weight of calcareous material). In this investigation, clean No. 2/12 Monterey sand will be used for the filter pack.

2.3 Setting Screens and Riser Casing

Upon completion of drilling, the boring will be sounded to verify the total depth, and the well casing will be assembled and lowered into the boring.

Well casing materials will be measured to the nearest 0.1 foot and steam-cleaned before being lowered into the borehole. The well assembly will be designed so that the well screen is placed opposite the formation target zone. No PVC cement or other solvents will be used to fasten the well casing joints, well screen joints, or end caps.

The well casing will be lowered and positioned at the at the desired depth interval. Once the well has been situated at the desired depth, sufficient filter sand will be emplaced to fill the annular space from the bottom of the boring to a level of about 1 to 2 feet above the top of the well screen. The depth to the top of the filter pack will be verified by measuring, using a tremie pipe or a weighted tape. Prior to final placement of the filter pack, a surge block will be repeatedly lowered and raised through the water column to promote filter material settlement firmly around the screen interval of the well. Following surging, additional sand will be added as required to bring the top of the sand surface to approximately 2 feet above the top of the well screen. Then, an approximately 1-foot thick interval of fine-grained filter pack will be emplaced to provide a transition zone between the bentonite seal and the filter pack.

Once the depth to the top of the filter material has been verified, bentonite chips will be placed in the annular space above the sand filter pack as a transition seal between the filter material and the grout. A sufficient quantity of bentonite chips will be placed to fill the annular space to a level of about 2 feet above the top of the filter pack. Bentonite chips will be placed in approximately 6-inch lifts. Unless prohibited by well conditions, each lift should be hydrated using approximately 1 gallon of potable water per lift. The completed bentonite transition seal will be allowed to hydrate for at least 30 minutes prior to placing the grout. The depth to the top of the transition seal will be verified by measuring, using the tremie pipe or a weighted tape.

A neat cement/bentonite grout will be installed from the top of the transition seal to the ground surface. Grout/additive/water mixtures will be determined on a site-specific basis. The typical neat cement/grout mixture consists of a mixture of one sack (94 pounds) of Portland Type I/II cement, approximately 2 to 5 percent by weight (of cement) powdered bentonite, and approximately 6 to 8 gallons of water. Only potable water will be used to prepare the grout. No work will be done on the monitoring well until after the grout has set at least 48 hours.

2.4 Surface Completion

Wells will be completed above grade. The wells will be protected with a steel above ground monument casing secured in a concrete base and extending approximately three feet above ground. All wells will be locked for security and will be designed to limit surface water infiltration.

2.5 Development and Surveying of Groundwater Monitoring Wells

When the well installation is complete and the grout has cured a minimum of 48 hours, the well will be developed by surging, bailing, and pumping. The objectives of well development are to remove drilling induced formation smear from the borehole walls, and to remove sediment that may have accumulated during well installation, and to remove mud from the walls of the borehole. Additional objectives include consolidation of the filter pack around the well screen, and to enhance the hydraulic connection between the formation target zone and the well. In most instances, a bailer will be used to remove sediment and turbid water from the bottom of the well. A surge block will then be used within the entire screened interval to flush the filter pack of fine sediment and formation smear from the borehole walls. Surging will be conducted slowly to reduce disruption to the filter pack and screen. The well will be

bailed again to remove sediment drawn in by the surging process until suspended sediment is reduced.

Following bailing and surging, the well will be further developed using air-lift or pumping methods. A bailer may be used for low-yield wells. If possible, the well will be developed at a higher pumping rate than the anticipated rate of future purging. During development, the turbidity of the water will be monitored, and the pH, specific conductance, and temperature of the return water will be measured. Drawdown and recovery will be measured during and at the end of the development process, respectively, using an electric sounder. Well development will proceed until sediment is removed sufficiently to obtain a turbidity measurement of 5 NTU in the return water. If the 5 NTU objective is not achieved after implementing this protocol, this condition will be stated in well installation report.

Following development, the wells will be surveyed by a licensed California land surveyor. Survey coordinates will be made in reference to a nearby benchmark of known mean sea level elevation. The survey data will be incorporated onto the site base map and will be used in estimating the local direction and gradient of groundwater flow.

2.6 Documentation

A well construction diagram for each well will be completed in the field on the Well Log by the field geologist/engineer and submitted to the reviewing geologist or engineer upon completion of each well. Well installation and construction data will be summarized on the Daily Field Record or on a specialized form produced for this purpose. Well development notes and field measurements of water quality parameters will be summarized on a Well Sampling and/or Development Record. Following review by the project manager, the original records will be kept in the project file.

3. CLEANING OF DRILLING EQUIPMENT

Cleaning of the drill rig and associated drilling equipment will follow the procedures discussed in Section 2 of the protocol Drilling and Destruction of Soil Borings.

All well casing materials will be cleaned before they are installed. Well development equipment will be cleaned before use. The following cleaning procedure has been found to be effective and will be used or adapted as appropriate for general conditions of materials or equipment to be cleaned.

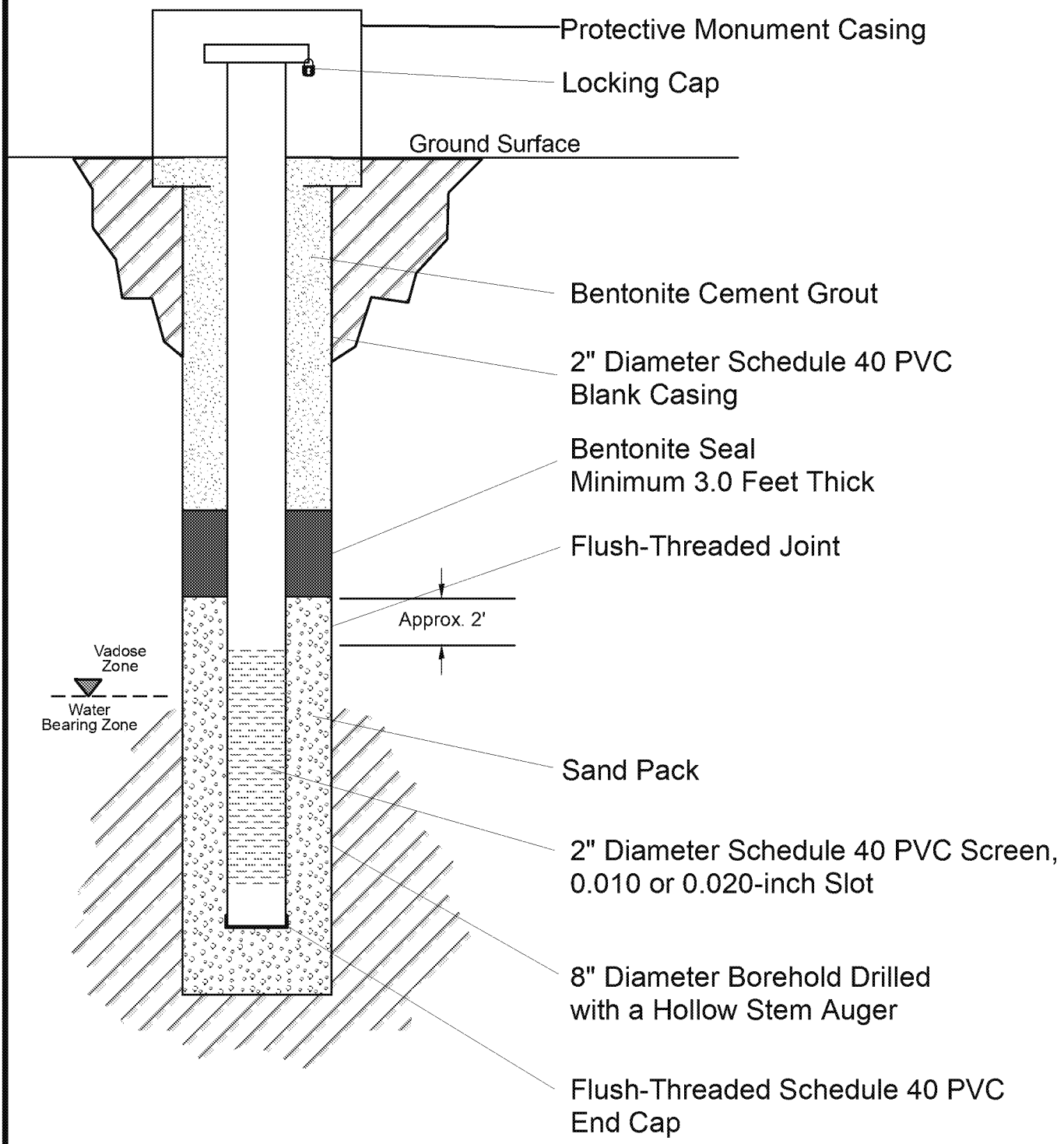
Steam-rinse with potable water or rinse in deionized or organic-free water.

Cover with clean plastic to protect materials and equipment from contact with chemical products, dust, or other contaminants.

Alternatively, well casing materials that have been steam-cleaned and sealed in individual airtight plastic bags by the factory can be used.

Decontamination rinsate will be collected and stored properly for future disposal by the client, unless other arrangements have been made.

Forms Used: Field Investigation Daily Log
Field Well Completion Log
Well Development Record
Typical Monitoring Well Construction Diagram



RAMBOLL

Above Ground Monitoring Well Construction

FIGURE
1

DRAFTED BY: LN | DATE: 12/7/2018 | PROJECT: 1690001847-004

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